ELEMENTS
OF THE
PRACTICE
OF
PHYSIC.

PART THE FIRST.

CONTAINING THE
NATURAL HISTORY
OF THE
HUMAN BODY.

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BOSTON ATHENÆUM

THIS ESSAY

ON THE ART OF HEALING,

IN TESTIMONY OF THE AUTHOR'S

GRATITUDE,

IS WITH THE GREATEST RESPECT,

INSCRIBED

TO HIS GRACE

HUGH DUKE OF NORTHUMBERLAND,

A LOVER AND A PROMOTER

OF USEFUL ARTS,

BY HIS GRACE'S

MOST OBEDIENT SERVANT,

GEORGE FORDYCE.

Isaac Rand's
1770

THE
NATURAL HISTORY
OF THE
HUMAN BODY.

A Diſeaſe is ſuch an alteration of the chemical properties of the fluids or ſolids, or of their organization, or of the action of the moving power; as produces an inability or difficulty of performing the functions of the whole, or any part of the ſyſtem, or pain, or a preternatural evacuation.

The Chemical Properties of the FLUIDS.

THE fluids may be divided into

1ſt, The blood.
2dly, Thoſe formed during digeſtion, before the food is converted into blood.
3dly, The ſecreted fluids.

The blood conſiſts of

1ſt, The ſerum.
2dly, The coagulable lymph.
3dly, The red part.
4thly, The ſuperfluous water.
5thly, Extraneous ſubſtances introduced.

The ſerum, coagulable lymph, and ſuperfluous water, are diffuſed through one another; and the red part is mechanically mixed with them. Some of the extraneous ſubſtances are alſo mechanically mixed with them, and ſome diffuſed through them.

PROPERTIES of the SERUM.

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IT is fluid in any degree of heat between 30 and 160 of Fahrenheit's thermometer.

In a leſſer heat it freezes, in a greater it coagulates.

Coagulation is a ſeparation of an animal or vegetable matter from the water in which it was diſſolved; and is at the ſame time a change of the properties of that matter, rendering it inſoluble in water again by commixture alone.

The ſerum conſiſts chemically of a coagulable matter, and water in which common ſal ammoniac and phoſphoric ammoniac, and generally common ſalt, and frequently ſelenites, and fixed ammoniac, are diſſolved; but it is a queſtion, whether the water chemically combined in the ſerum is alſo united with thoſe neutral ſalts, or whether the ſerum, and the ſolution of theſe, are only diffuſed through one another.

It is probably in itſelf colourleſs, and inodorous; but it receives a yellowiſh or browniſh hue from the putreſcent part of the blood, and acquires a ſmell from the eſſential oil.

If it contained no neutral ſalts, it would be inſipid, and incapable of ſtimulating.

The ſuperfluous water may be ſeparated from it by filtration in the body, but that which is chemically combined with the other parts cannot.

All the water may be evaporated from it by a leſſer heat than 140 degrees of Fahrenheit's thermometer, if it be expoſed to the air. The other parts remain after this operation ſolid, and ſoluble again in water by commixture alone.

The ſeparation or addition of ſuperfluous water does not affect its viſcidity, ſo far as that is of any conſequence in the circulation; but the ſeparation of that water which is in chemical combination, may render it more viſcid.

The water in chemical combination is never ſeparated, while the ſerum is contained in the blood-veſſels; and of conſequence this part of the blood is always equally viſcid, ſo far as its viſcidity can affect the circulation or ſecretions.

It may be coagulated by acids, oils, alcohol, &c. but no ſubſtance can get into the blood-veſſels in a ſufficient degree of concentration to coagulate it, excepting by injection.

It may be coagulated by a juice ſecreted in the ſtomach.

It has ſeldom, if ever, been found coagulated in the body.

The only perceptible difference which has appeared in the coagulable part of the ſerum, from any obſervation hitherto made public, is, that ſometimes in coagulating its parts adhere more or leſs firmly, and that ſometimes it is of a deeper or lighter brown colour.

PROPERTIES of the COAGULABLE LYMPH.

IT is a compound of water and a coagulable matter.

As long as it continues in the courſe of circulation, it is fluid in any degree of heat between 30 and 120 degrees of Fahrenheit's thermometer.

When it is taken out of the blood-veſſels, it coagulates; whether it be in motion or at reſt, expoſed to the air or not, or in the heat of the human body, or in any other degree of heat.

If it be retained in a blood-veſſel, it continues fluid for more than three hours in any degree of heat between 30 and 120 of Fahrenheit's thermometer, and that whether it be in motion or at reſt. The ſmaller the blood-veſſel, the longer it continues fluid.

It has hardly ever been found coagulated in the blood-veſſels of a living animal, unleſs they have been enlarged into aneuriſms or varices.

It has generally been found coagulated in the large veſſels of the human body on diſſection, and ſometimes ſeparated from the other parts; but to all appearance theſe coagulations have almoſt always taken place after death.

When it is taken out of the blood-veſſels, it may be prevented from coagulating, by ſaturating the whole blood with common ſea-ſalt, and perhaps by ſome of the other neutral ſalts.

Although the coagulable part of the ſerum and coagulable lymph have different properties, the coagulum formed from both is pretty nearly the ſame.

The coagulum may be diſſolved in water by boiling or putrefaction; and may be united with concentrated acids, with cauſtic alkalis, and calcarious earth, and with ſome metallic ſalts, into a ſubſtance ſoluble in water: but none of theſe can get into the ſyſtem by abſorption, ſo as to produce this effect.

Both the ſuperfluous water and ſerum are capable of being ſeparated from the coagulable lymph, by filtration in the body.

When the blood is received into a proper veſſel, the coagulation of this part gives an appearance of ſolidity to the whole: but ſoon after the whole becomes thus apparently ſolid, part of the ſerum, of the ſuperfluous water, and of the water which was combined with the coagulable lymph, ouzes out from the whole maſs, and brings along with it part of any extraneous fluid that may be contained in the blood-veſſels; leaving behind what is commonly called the red globules, the coagulum of the coagulable lymph, and any ſolid particles that may have been in the blood. This is called the ſpontaneous ſeparation.

When the arteries are acting ſtrongly, whether the whole habit be ſtrong or not, the coagulable lymph is more fluid, and longer in coagulating. Of conſequence it lets the red particles, which are the heavieſt part of the blood, fall down towards the bottom, before it coagulates: and upon the ſpontaneous ſeparation, the coagulum is divided into two parts; the upper, conſiſting of the coagulum of the coagulable lymph alone (which has in this caſe been called the buff); the under, conſiſting partly of this, and partly of the red particles.

Although part of the coagulable lymph would ſeparate from the red particles, may be prevented by taking the blood from a ſmall veſſel, or from a ſmall orifice, or by letting it run along the ſkin before it falls into the veſſel into which it is received, or by receiving it into a veſſel whoſe ſurface is large in proportion to its contents; as in all theſe caſes the coagulation is forwarded. On the other hand, if it ſtagnate in the blood-veſſel for ſome time before it is taken out, there will be a ſeparation, when none would otherwiſe have happened.

Whether the coagulable lymph ſeparates in part from the red particles, or not, it coagulates ſometimes into a firmer, ſometimes into a looſer maſs, generally in proportion to the ſtrength of the ſyſtem.

All the ſubſtances which coagulate the ſerum, have the ſame effect on the coagulable lymph; but none can be applied to it in the blood-veſſels, excepting by injection in a ſufficient degree of concentration to coagulate it.

The coagulable lymph is probably in itſelf colourleſs, inſipid, inodorous, and incapable of ſtimulating.

Whilſt it remains in the blood-veſſels, it is chemically combined with a certain proportion of water, from which it cannot be ſeparated but by coagulation; neither will it combine with a larger proportion.

Water mechanically mixed with it has no effect on its viſcidity, ſo far as that affects the circulation or ſecretions.

No other differences beſides thoſe already taken notice of are obſervable in its properties.

The coagulable lymph and ſerum are both capable of putrefaction, and are converted by it into a mucilaginous matter, not coagulable by any of the methods recited above.

If this mucilaginous matter ſhould undergo a further putrefaction, it emits a fœtid vapour, and is converted into ſaline ſubſtances and calcarious earth.

PROPERTIES of the RED PART.

UPON viewing this part of the blood with a deep magnifier in the ſolar microſcope, as it circulates in the blood-veſſels of a living animal, it appears to be divided into a number of ſmall particles, which are apparently annular, and exceedingly flexible.

While the animal is reſpiring, and the blood circulating, it is of a ſcarlet colour in the arteries, and of a Modena red in the veins; but if the reſpiration be ſtopped, that blood which circulates afterwards through the lungs continues of a Modena red. If it be taken out of the veins, kept moiſt, and expoſed to reſpirable air, it becomes of a ſcarlet colour; if it be taken out of the arteries, and covered from the air, or if it ſtagnate in them, its colour is changed to a Modena red. A light ſhade of Modena red is not ſcarlet, neither is a deep ſcarlet a Modena red. Various other ſubſtances alter the colour of this part.

It ſeems to have a ſweetiſh taſte, to be inodorous, and void of ſtimulus.

Its ſpecific gravity is but a very little more than the ſerum or coagulable lymph.

It is more inflammable than the other parts; and, on performing its chemical analyſis, it yields a large proportion of empyreumatic oil.

It is readily ſoluble in water, but not in the ſerum.

It is not ſoluble in a ſaturated ſolution of neutral ſalts.

It is capable of undergoing the putrefactive fermentation, the firſt ſtage of which breaks it down into ſmaller particles, and renders it of a dark colour. It afterwards is converted into a mucilage, and becomes ſoluble in the ſerum.

The Superfluous Water.

IT is diffuſed through the ſerum and coagulable lymph.

It contains a part, perhaps the whole, of the ſalts.

Theſe ſalts are chemically combined with a part of it only, and this ſolution is diffuſed through the remaining part.

The water diffuſed may be ſeparated from the ſolution by filtration in the body.

The ſolid part of the blood, left after evaporation of the water by a heat leſs than that of boiling water, amounts to from one fourth to one fifth of the whole.

Extraneous Substances.

A Great variety of extraneous ſubſtances, both fluid and ſolid, may be introduced into the blood-veſſels by abſorption; but none of them in ſuch proportion as to produce any alteration in the blood, except by fermentation.

When any ferment is introduced into the blood-veſſels, it acts upon a part of the blood only; the greateſt part remaining to all experiment exactly the ſame as before.

Of the PUTREFACTION of the BLOOD.

FErmentation is the converſion of one compound into another, by a new arrangement or manner of combination of its elements.

What is commonly called putrefaction conſiſts of two fermentations, which we ſhall call by the names of the firſt and ſecond ſtage.

All animal ſolids and fluids may be reduced by the firſt into a mucilaginous maſs, ſoluble in water, and diffuſible through any quantity of it.

The red part of the blood firſt breaks down into ſmaller particles, before it is formed into a perfect mucilage.

The firſt ſtage takes place without any effervescence.

The ſecond ſtage converts this mucilage into earths, and ſalts, a fœtid vapour, and fixable air.

The firſt and ſecond ſtage of putrefaction take place in a ſmall part of the blood, or it is deſtroyed by ſome other operation; for

After having coagulated the ſerum, if we ſqueeze out the water, and evaporate it, there is left a mucilaginous matter ſimilar to that formed by putrefaction.

The ſalts formed in the blood-veſſels, excepting phoſphoric ammoniac, may be formed by the laſt ſtage of putrefaction; and thoſe formed by the laſt ſtage are found in the blood-veſſels, excepting nitrous ſelenites, and nitrous ammoniac.

This mucilage, and theſe ſalts, are always carrying off by urine; the preſent blood is always diminiſhing, and the veſſels require a freſh ſupply from the food.

The blood is always in the moſt powerful circumſtances of putrefaction; which are, a heat of 98 degrees of Fahrenheit's thermometer, fluidity, a moderate expoſure to air, and motion: but it is prevented from putrifying by the action of the veſſels; nor can any ferment or other circumſtance induce the fermentation, till this action is altered, except perhaps the introduction of chyle intermixed with putrid matter.

In diſeaſes, the firſt ſtage often takes place in part of the blood; the ſecond ſtage ſometimes, although ſeldom.

Of Digestion.

DIGESTION is the converſion of the food into chyle, and afterwards into blood.

The food may conſiſt of farinaceous or mucilaginous vegetable ſubſtances, or native vegetable acid, or ſugar, or expreſſed oil, or animal ſolids, or animal fluids containing a mucilaginous matter.

Theſe ſubſtances may be digeſted, if they be taken ſingly, or if they be mixed together.

The blood formed does not differ ſenſibly in its properties, whether the one or the other of them be uſed ſingly, or ſeveral of them together; provided the organs of digeſtion be ſufficiently powerful convert them into blood.

If the food be ſolid, it is generally broke down by the teeth, or by ſome other apparatus.

But maſhing it down with water is not ſufficient to alter its chemical properties, and convert it into chyle and blood.

It is mixed in the ſtomach with the watery fluids we drink, and with the mucilaginous watery fluids ſecreted by the ſalivary and other glands.

It is ſometimes diſſolved in water before it is uſed: but it is often rendered ſolid by a previous preparation, or coagulated by a ſubſtance ſecreted in the ſtomach.

Simple ſolution in water does not convert it into chyle or blood.

If it be previouſly diſſolved in water, it affords leſs nouriſhment than if exhibited ſolid.

It is neceſſary that it remain in the ſtomach for ſome time, in order to its digeſtion.

The only proceſs it can go through in the organs of digeſtion, that is capable of altering its chemical properties, is fermentation.

Its fermentation is not attended with efferveſcence in a healthy ſtomach.

If vegetable food be uſed, an acid is produced. This acid is deſtroyed in the duodenum by the bile.

If animal food be uſed alone, no acid is produced.

The ſtronger the ſtomach, and the more perfect the digeſtion, the leſs acid is formed from vegetable food.

No ſtage of the putrefactive fermentation takes place, during the converſion of it into chyle and blood, if the digeſtion be perfect.

The fermentation which takes place is peculiar to the organs of digeſtion, and has never been produced by any artificial means yet attempted.

The fermentation which takes place in the ſtomach, forwards the ſolution of ſolid food in the watery menſtruums.

Solid foods diſſolve ſooner in the ſtomach than they can be diſſolved in water in the ſame heat, by any means hitherto found out.

If the ſtomach does not act properly, ſolid food remains undiſſolved; vegetable, and mixtures of vegetable, and animal ſubſtances become more acid; animal ſubſtances putrify; a quantity of air is ſeparated; and the food is not digeſted and converted into chyle.

Only that part of the food which is digeſted affords nouriſhment; the nouriſhment therefore is in proportion to the food and the digeſtion.

When food, either from its quantity or quality, cannot be digeſted, it is apt to occaſion great diſturbances in the ſyſtem, while it is contained in the ſtomach and inteſtines.

The only ſenſible alterations produced in the blood by different foods, are in its quantity; or in the proportion of ſuperfluous water; or that ſometimes a long uſe of animal food brings on a degree of putrefaction.

Of the CHYLE.

THE chyle is formed from the food in the inteſtines, and abſorbed by the lacteals.

The whole fluid abſorbed is not chyle, but a mixture of chyle, and the ſolution of thoſe ſubſtances, which were ſimply diſſolved in water without being digeſted.

Quere, Whether a ſimple ſolution of mucilaginous, animal, or vegetable ſubſtances, can be converted into blood, without being formed into chyle in the ſtomach and inteſtines?

Chyle is fluid, while in the lacteals; when expoſed to the air, it coagulates; it is rendered white, from a mixture of expreſſed oil.

When coagulated, a fluid may be ſqueezed out, which probably contains a coagulable matter, and ſugar.

The SECRETED FLUIDS.

THEY either

Exiſt in the blood-veſſels, being mechanically mixed with the other fluids, and require only a mechanical ſeparation;

Or they do not exiſt in the blood-veſſels, their elements only being contained there: but theſe elements are not combined, ſo as actually to form the ſecreted fluid. It is therefore requiſite, that ſome chemical operation ſhould take place in the ſecretory organ, by which the elements ſhall be combined ſo as to form the matter ſecreted.

The chemical operation by which they are formed, is fermentation.

The fluids ſeparated mechanically, are

The matter of the inſenſible perſpiration.
The urine.
The ſweat.
The milk.

The fluids formed in the ſecretory organ by a chemical operation, are

The mucus.
The ſaliva.
The pancreatic juice.
The ſemen.
The bile.
The wax in the ear.
The ſebaceous matter.
The coagulating matter of the ſtomach, *&c.*

The

The MATTER of the INSENSIBLE PERSPIRATION.

IT is ſeparated from the ſurface of the lungs, and from the ſkin, by evaporation.

The quantity evaporated depends upon the quantity of ſuperfluous water in the blood-veſſels, the heat of the air, the quantity of air applied, and the contraction or relaxation of the veſſels from whence the evaporation takes place.

When the body is in its natural ſtate, that part of the inſenſible perſpiration, which is capable of condenſation, conſiſts of water, with a very ſmall proportion of a mucilaginous matter and eſſential oil, and ſometimes perhaps volatile alkali.

There is no reaſon to ſuppoſe, that any matter flies off that cannot be condenſed, from any experiment hitherto made; but it is rather probable that there is not.

Should any other ſubſtance, capable of emitting vapour in the heat of the human body, get into the blood-veſſels, or be formed on the ſurface of the ſkin, lungs, or in any of the paſſages of the air in breathing, it may be mixed with the inſenſible perſpiration.

Some of theſe ſubſtances may be putrid vapour, variolous, morbillous, and other infectious matters, alcohol, and other extraneous volatile ſubſtances, &c.

The matters thrown off by inſenſible perſpiration, may be evacuated by the other excretions.

The health is not in proportion to the quantity of inſenſible perſpiration.

The URINE.

THE urine, in the common ſtate of the body, is a tranſparent browniſh fluid, which upon cooling has a mucilaginous matter ſeparated, capable of being rediſſolved in heat.

In health, the ſeparating mucilage is generally in ſuch quantity as to remain ſuſpended in the urine after its ſeparation, forming what has been called the cloud.

It is ſometimes totally abſent in health, but much more frequently in diſeaſes; ſometimes it is in quantity ſufficient to carry the cloud to the bottom, and form a mucous ſediment; and ſometimes it falls down in a flaky powder, and forms what has been called a lateritious ſediment, which is commonly of a brick colour, and now and then white.

This laſt appearance often takes place on the going off of acute diſeaſes; but it alſo happens in health, and while diſeaſes ſubſiſt in their full force, particularly when they affect the urinary paſſages, or parts near them.

Sometimes the ſeparating mucilage is ſeparated in a powder, remains ſuſpended in the urine, and renders it turbid.

After the ſeparating mucilage is ſeparated, if the urine be filtrated from it, it is tranſparent, conſiſting of water which contains a mucilage, and ſalts.

1*ſt*, A mucilage, ſimilar to that formed by the firſt ſtage of putrefaction.

This mucilage is of a browniſh colour, and gives the greateſt part of the colour to the urine.

Its quantity varies conſiderably; but the proportion of it in the urine is always ſmall.

If the water be evaporated from it, it will rediſſolve, and it may be diffuſed through any quantity of water in any heat.

It is not coagulable.

2*dly*, The ſalts are common ſalt, common ſal ammoniac, phoſphoric ammoniac, vitriolic ſelenites, and muriatic ſelenites.

Common ſalt is contained in the urine, in conſequence of its being uſed in the food, or drink; and it is in proportion to the quantity uſed.

The other ſalts are contained in the urine independent of any ſaline ſubſtance taken into the body, except perhaps the vitriolic ſelenites.

The quantity of ſelenitic ſalts is commonly very ſmall; but ſometimes the urine is ſaturated with vitriolic ſelenites, which ſeparates, and chryſtalizes, upon the urine's ſtanding to cool.

The proportion of the ſalts varies conſiderably, but is always ſo ſmall as to form a diluted ſolution.

The ſolution is generally ſufficiently concentrated, to ſtimulate a very irritable part, but not always.

The dilution depends on the quantity of ſuperfluous water in the blood-veſſels, and on the quantity of that ſuperfluous water evacuated by the kidneys: ſo that, when the quantity ſecreted is large, the ſolution is generally diluted; when ſmall, more concentrated.

Watery fluids may paſs through the blood-veſſels, and by the kidneys, hardly carrying off any thing with them, eſpecially if large quantities be drank at a time, and the external veſſels be contracted.

Sometimes a quantity of calcareous earth is found in the urine, ſuſpended by mechanical mixture, or at leaſt not combined with an acid.

Any extraneous ſubſtance, ſoluble in water, that may get into the blood-veſſels, may be evacuated along with the urine; ſuch as acids, alkalies, neutral and other ſaline ſubſtances; infuſion of rhubarb, and other mucilaginous vegetable juices; bile, pus, and other fluids formed in the body.

If the kidneys are relaxed, or ſtimulated; chyle, ſerum, coagulable lymph, and even the red part of the blood may be thrown out.

The red part may alſo be broke down by putrefaction, and paſs off by the kidneys, of a very dark colour, diſturbing the tranſparency, and ſometimes forming a ſediment.

If the heart and arteries act more ſtrongly, or frequently, than they do in their natural ſtate, a quantity of expreſſed oil comes away with the urine, and forms a film on the ſurface, or a ring round the veſſel into which it is received.

The urine always contains a portion of the eſſential oil of the urinary paſſages, and ſometimes a portion of their mucus.

The SWEAT.

AS far as we are capable of judging from the ſmall quantity that can be collected, it contains nearly the ſame ſubſtances as the urine; only that inſtead of the eſſential oil of the urinary paſſages, it is mixed with the ſebacious matter of the ſkin, which gives it a degree of whiteneſs, and a ſmell different from that of the urine.

The MILK.

IT is ſecreted naturally in the breaſts of women for the nouriſhment of their young, ſometimes during pregnancy, and always after child-birth. There are ſaid to have been inſtances of its being ſecreted at other times, and from other parts of the body.

It is a whitiſh fluid, which ſeparates into two parts upon being left at reſt in a moderate degree of heat: The upper part conſiſts principally of expreſſed oil, with a mixture of the other part, and is whiter and more opaque.

The under part conſiſts of a ſolution of coagulable matter and ſugar, in water; with a ſmall mixture of expreſſed oil, and is called the ſkim-milk.

The expreſſed oil is fluid in the heat of the human body, but ſolid in the heat of the atmoſphere.

It is only mechanically mixed with the other part.

It is tinged with, and receives a flavour from, the eſſential oil of the food and of the body.

It is found not only in different proportions in the milk of different women, but alſo in the milk of the ſame woman at different times, and even in that which iſſues from the different excretory ducts of the glands of the ſame breaſt.

The coagulable matter only differs from the coagulable matter of the ſerum, in its coagulability, and its proportion to the water.

It is not coagulable by a leſs heat than that of boiling water, and by that only, if the water be evaporated from it.

It may be coagulated by acids, alcohol, ſeveral metallic and aluminous ſalts, and vegetable juices; but it requires that they ſhould be applied to it in a greater degree of concentration than the ſerum does, in order to its coagulation.

Heat aſſiſts the coagulating power of theſe ſubſtances.

It is readily coagulable by the coagulating juices of the ſtomach, and coagulates in the ſtomach of a living animal, whether any acid be contained in it or not.

The ſugar contained in the milk does not differ in its properties from that of the ſugar-cane.

Its proportion is always ſmall.

When a woman makes uſe of vegetable food, it ſeems to be in greater proportion than when ſhe uſes animal.

The milk of a bitch, uſing animal food alone, contains ſugar.

If milk be kept for ſome time expoſed to the air, and in the heat of the atmoſphere, or of the human body, the ſugar ferments, and is converted into vinegar, which coagulates the coagulable matter.

The ſame change may take place in the breaſt, if it ſtagnate there for ſome time, or if the woman be ſuddenly affected with any of the paſſions of the mind that are attended with anxiety.

If blood be taken from the arm after a full meal, the ſerum is often mixed with a ſubſtance which gives it a degree of whiteneſs and opacity.

The milk is ſecreted after a full meal in larger proportion, than after a woman has faſted for ſome time.

In the latter caſe, the proportion of the expreſſed oil, coagulable matter, and ſugar, likewiſe diminiſhes, and the milk contains beſides theſe the neutral ſalts of the blood, and acquires a bitterneſs from the ſebacious matter of the glands of the nipples.

In ſome women the milk always contains the ſalts of the blood, or the ſebacious matter of the nipples.

The ſebacious matter not only gives it a bitter taſte, but alſo, ſometimes, a yellowiſh colour and a thicker appearance.

The milk may contain any ſubſtance which is thrown into the ſtomach, and ſimply diſſolved in water, without going through the digeſtive fermentations, and being converted into chyle.

The MUCUS.

IT covers the ſurfaces of the membranes that are expoſed to any extraneous matter, ſuch as the ſkin and internal membrane of the mouth, noſe, lungs, œſophagus, ſtomach, inteſtines, urinary paſſages, &c.

It

It is a fluid of an adheſive viſcidity approaching to a ſolid, and of greater viſcidity in one part than in another.

It is a compound of a coagulable matter and water.

It is more or leſs viſcid, according to the quantity of water with which it is combined.

It is of different degrees of viſcidity in different parts of the body.

It will not combine with more water than what is already contained in it; neither can its viſcidity be altered by digeſting it with water, unleſs it begin to putrify; nor can the more viſcid mucus of one part be converted into the leſs viſcid of another.

If the water be evaporated from it by a gentle heat, the coagulable matter remains ſolid: if this be immerſed in water, it will abſorb that quantity which evaporated from it, but no more, and it will regain its former fluidity and viſcidity.

It, for the moſt part, contains either no neutral ſalts, or ſo ſmall a proportion as cannot eaſily be rendered ſenſible to experiment. It is colourleſs, inſipid, inodorous, and incapable of ſtimulating.

It combines with concentrated vitriolic, nitrous, and muriatic acids, with concentrated ſolutions of ſome metallic ſalts, and alſo with concentrated or diluted ſolutions of cauſtic alkalies and cauſtic calcarious earth, into compounds ſoluble in, and diffuſible through water.

Acids and ſome metallic ſalts diſſolved in water, and concentrated, but not to that degree as to diſſolve it, alcohol and aluminous ſalts coagulate it. It is alſo coagulable by the heat of boiling water, but not by a leſs degree of heat.

The mucus defends the membranes from being ſo much ſtimulated by any application as they would be, if they were not covered with it.

If the ſecretion be ſuddenly increaſed, the matter ſecreted is often a thin watery fluid containing the ſalts of the blood, and in conſequence of them capable of ſtimulating; and the membranes are not defended from external applications.

If a greater ſecretion ſhould continue than what naturally takes place, the mucus retains the ſalts, but often acquires a viſcidity, and becomes incapable of being diffuſed through water: its colour alſo often grows white, greeniſh, or yellow; and now and then it acquires a ſmell.

The SALIVA.

IT is ſecreted by ſeveral glands in the mouth; and the principal part of it is thrown down into the ſtomach, to anſwer ſome purpoſe in the digeſtion of the food.

It is a fluid of an adheſive viſcidity, with difficulty diffuſible through water.

It conſiſts of water, a coagulable matter ſimilar to that of the mucus, and the ſalts of the blood, but not in ſo large a proportion as they are contained in the ſerum.

It contains a larger proportion of water than the mucus.

In its other properties it is ſimilar to the mucus.

The PANCREATIC JUICE.

IT appears to be ſimilar to the ſaliva, except that it is leſs viſcid, and contains a larger proportion of the ſalts of the blood.

The ſaliva and pancreatic juice are probably watery menſtrua for the ſolution of the food in the ſtomach and inteſtines, their viſcidity preventing them from being abſorbed before they produce that effect.

They have been ſaid to act as ferments during the digeſtion; but as the fermentations of the ſtomach have never been made to take place out of it, we cannot judge of this by any experiment hitherto communicated to the public.

The BILE.

THE blood from which the bile is formed has probably gone through one circulation, without being expoſed to the air in the lungs, or mixed with the fluids brought by the lymphatics from the different parts of the body.

The blood, from which the bile is formed, paſſes through the veſſels of the abdominal viſcera, before it arrives at the liver; but it does not take up any ſubſtance from them, or at leaſt not in ſuch a quantity as to be ſenſible to any experiment yet made; but, on the contrary, it appears perfectly ſimilar in all ſenſible qualities to the blood returning by the veins from the other parts of the body.

There is no appearance of bile in the vena portarum of a living animal.

When bile in the jaundice is contained in the blood-veſſels, it is ſecreted by all the ſecretory organs, and it is evidently contained in all the ſecretions.

The bile is formed from the blood in the ſecretory veſſels of the liver.

It runs along the hepatic ducts into the ductus communis cholidochus, and from thence partly into the duodenum, and partly into the gall-bladder.

It continues for ſome time in the gall-bladder, and becomes more perfect in its properties there; from thence it returns into the ductus communis cholidochus, and paſſes into the duodenum.

The bile is a fluid of an oleaginous viſcidity, conſiſting of a ſolution of a ſolid matter in water.

If the water be not evaporated from it, no alteration is produced on it by any heat between 32 and 112 degrees of Fahrenheit's thermometer.

The bile is diffuſible in any proportion of water.

If the water be evaporated from the ſolid part by a heat not exceeding 112 degrees of Fahrenheit's thermometer, it is ſoluble in, and diffuſible through, any quantity of water.

The ſolid matter of the bile melts if it be heated, and is decompoſed if the heat be encreaſed.

If it is diſtilled by itſelf, it yields a larger proportion of empyreumatic oil than any of the other fluids, except the expreſſed oil and red part of the blood.

It is of a yellow colour, and a ſweetiſh bitter taſte.

When it is not combined with more water than it generally is in the gall-bladder, it does not putrify more readily than the blood; but if it be diluted with water or watery fluids, it putrifies more readily.

Acids and ſome of their compounds decompoſe it, and precipitate from it a reſinous matter.

The acidity of the acid is loſt by its combination with the other part; but if more acid be employed than what is neceſſary for the decompoſition, the acidity of the ſuperfluous quantity remains.

The matter precipitated has the peculiar ſmell of the animal.

It is ſolid in the heat of the atmoſphere, melts in a moderate degree of heat, and burns very readily.

It is not ſoluble in water.

It is partly ſoluble in alcohol.

If the paſſage of the bile into the duodenum be ſtopt, acidities are apt to take place in the inteſtinal canal, the periſtaltic motion does not go on properly, the fæces loſe their peculiar colour and ſmell, and often acquire a more putrid fœtor, and the digeſtion is hurt, but not entirely prevented.

The properties of the other ſecreted fluids have not been ſufficiently inveſtigated by experiments for us to be able to give any ſatisfactory account of them.

The CHEMICAL PROPERTIES of the ANIMAL SOLIDS.

THEY are a compound of a coagulable matter and water.

They are naturally flexible; but, if the water be evaporated from them by a gentle heat, they become friable.

The water chemically combined, cannot be ſeparated from them by expreſſion. Expoſed to about a red heat, they are decompoſed; and if they be diſtilled by themſelves, volatile alcali, empyreumatic oil, water, and calcareous earth, are formed.

When free from eſſential oil, blood, and the ſalts of the fluids, they are colourleſs, inſipid, and inodorous.

They differ in their flexibility and elaſticity.

Fibres and membranes are readily flexible, not capable of being broke by bending, and have a leſs degree of elaſticity.

Cartilage is leſs flexible, capable in general of being broke by bending, and more elaſtic.

Cartilage often ſupplies the place of bone in young animals.

Heat, dilute acids, neutral ſalts, alcohol, metalic, and aluminous ſalts, aſtringent juices of vegetables, and ſeveral other ſubſtances, coagulate them, *i. e.* ſeparate part of the water chemically combined, and of conſequence contract them, diminiſh their flexibility, and harden them. Subſtances coagulating the animal ſolids, are called Aſtringents.

If they be expoſed to a freezing cold, the water freezes; and upon thawing their texture is found to be altered.

Concentrated vitriolic, nitrous, and muriatic acids, cauſtic alkali's, even in a diluted ſolution, quick lime, and ſeveral of the metallic ſalts, combine with them into a ſubſtance diffuſible through, or ſoluble in, water, and deſtroy their texture.

They are capable of putrefaction in the ſame manner as the animal fluids.

The GENERAL STRUCTURE of the BODY.

The BLOOD-VESSELS.

THERE are cavities in the body, called blood-veſſels, in which the red part of the blood, the coagulable lymph, and part of the ſerum and ſuperfluous water, are uſually contained.

They conſiſt of the heart, arteries, capillaries, and veins.

The heart conſiſts eſſentially of two cavities, there being two hearts, properly ſpeaking, joined together in the human body, ſerving for two circulations of the blood; one through every part of the body, and one through the lungs.

The left ſide of the heart ſerves for the general circulation, and conſiſts of two cavities, the auricle and the ventricle.

The auricle is a cavity which opens into the pulmonary veins at one end, and into the ventricle at the other. There is a valve placed at the opening into the ventricle, which prevents any fluid from paſſing from the ventricle into the auricle.

The auricle is in part covered with muſcular fibres.

The ventricle is a cavity ſurrounded with muſcular fibres, having one opening into the auricle, and another into a pipe, called the aorta or great artery.

At the opening into the aorta, there are valves, which prevent any fluid from paſſing from the aorta into the ventricle.

The aorta is a tube which begins at the heart, and dividing into ſeveral branches, goes to every part of the body.

It does not divide at once, but branches out as it paſſes along.

When it has arrived at any part, and divided into very ſmall branches, theſe open into one another, ſo as to have a free and perfect communication every way: from theſe ariſe a ſmaller ſet of tubes, which alſo communicate in the ſame manner; and from them again ariſe a larger ſet, which have likewiſe a free communication.

The firſt ſet have been called capillary, or anaſtomoſing arteries: the ſecond have not got a name; the third have been called capillary veins; but I would term all of them capillary veſſels.

From the third ſet ariſe tubes which terminate in the heart, joining together as they go on towards it, and forming principally two large tubes, which open into the right auricle.

Theſe are called veins.

The veins which are ſubject to frequent compreſſion, from the action of the muſcles, have valves which open towards the heart.

Each artery, capillary, and vein, is nearly cylindrical, but ſomewhat irregular in its diameter.

No muſcular fibres appear on the arteries, capillaries, or veins in the human body.

Theſe veſſels are all of them elaſtic, and capable of being diſtended, ſo as to contain a larger quantity of fluid than what is neceſſary to render them cylindrical.

Their elaſticity is not ſufficient to overcome the weight of their ſides and keep them cylindrical, if they are not filled with a fluid, excepting in that part of the aorta neareſt the heart.

When an animal is dead, and no chemical or mechanical change has taken place in the veſſels, the elaſticity is the ſame as when the animal was alive.

When an animal is dead, and the veſſels act by their elaſticity alone, they are incapable of contracting to half the ſize they are of at their utmoſt diſtention, ſuppoſing them to continue cylindrical.

When an animal is alive, the blood-veſſels are always cylindrical, excepting when they are compreſſed by a conſiderable external force.

They are always full of blood.

When an animal is alive, the veins, capillaries, and ſmall arteries, are ſometimes contracted to leſs than half the ſize they are of at other times; therefore the veins, capillaries, and ſmall arteries, in a living animal, have a contractile power independent of their elaſticity, by which they adapt themſelves to the blood, and continue cylindrical.

This power is ſimilar to the muſcular power.

When the veſſels contain more blood they become longer, or their diameter is enlarged, or both; and, *e contra*,

When they contain leſs blood, they become ſhorter, or their diameter diminiſhes, or both.

The contractile power of the veſſels is capable of diminiſhing either their length or diameter.

When an animal dies, the arteries and veins loſe their cylindrical form, and are flattened, and the capillaries contain leſs blood in them.

The arteries, veins, and capillaries of a living animal, are commonly contracted to a greater degree than they can be by their elaſticity.

The elaſticity is commonly endeavouring to diſtend them.

If the veſſels are emptied to ſuch a degree that they cannot adapt themſelves to the blood, and continue cylindrical, the animal dies.

The moſt eſſential effort of the living power, is, to adapt the veſſels to the blood.

The COURSE of the CIRCULATION of the BLOOD.

THE blood paſſes from the left auricle of the heart into the left ventricle, from the left ventricle into the aorta, and from thence by the ſmaller arteries to the capillaries in every part of the body; from theſe it returns by the veins to the right auricle of the heart. The blood, for the moſt part, moves in one uniform direction in each artery, viz. from the heart towards the capillaries: it alſo moves in one uniform direction in each vein, viz. from the capillaries towards the heart; but although it moves in general from the arteries through the capillaries into the veins, yet its direction in any one capillary may be, and often is, altered and reverſed.

Both the general velocity with which the blood moves through the whole ſyſtem, and the proportional velocity of its motion in particular veſſels, are conſtantly varying.

The POWERS producing the CIRCULATION of the BLOOD.

THE force with which the blood moves in the veins, and the muſcular contraction of the auricle, which takes place during the relaxation of the ventricle, propels the blood into the ventricle.

When a certain quantity of blood is propelled into the ventricle, its muſcular fibres contract, being probably ſtimulated thereto by the blood.

This contraction of the muſcular fibres of the ~~right~~ left ventricle diminiſhes or obliterates it, and propels the whole, or part of the blood contained in it, into the aorta; the valve placed at the opening of the auricle into the ventricle, preventing its return into the auricle.

When the ventricle has emptied itſelf into the aorta, it relaxes and receives a freſh quantity of blood from the auricle; the blood being prevented from returning from the aorta by the valves placed at its opening into the heart.

The action of the heart tends to produce an equal and uniform circulation in every part of the body.

The CIRCULATION *doth not depend on the* ACTION *of the* HEART *alone.*

The circulation is not equal and uniform through the whole body, but the ſame quantity of blood flowing from the heart, a greater proportion of it ſometimes circulates through one part, ſometimes through another.

If the heart be the ſole power propelling the blood forward, the circulation can only be increaſed in any one part by an increaſe in the ſize of the veſſels, or removal of ſome obſtruction to the circulation there, or a diminution of the ſize of the veſſels, or obſtruction to the circulation in the reſt of the body; and *e contra* the circulation can only be diminiſhed in one part by a diminution of the ſize of the veſſels, or obſtruction to the circulation there, or an increaſe of the ſize of the veſſels, or a removal of ſome obſtruction to the circulation in the other parts of the body.

The principal cauſes producing an alteration of the ſize of the veſſels, or an obſtruction to the circulation, are,

1*ſt*, An increaſe or diminution in the diſpoſition to contraction in the capillary veſſels, or in the external preſſure.

2*dly*, The meeting of the ſtreams of blood in the anaſtomoſing veſſels.

3*dly*, The attraction of the blood to the ſides of the veſſels.

The diſpoſition to contraction in the capillaries of a particular part, or the external preſſure, may be increaſed, ſo as actually to produce a diminution of the ſize of the veſſels of that part, (notwithſtanding the action of the heart,) and by conſequence a diminution of the circulation of the blood in that part.

As the obſtruction ariſing from the meeting of the ſtreams of blood in the anaſtomoſing veſſels depends on the velocity with which it moves, it tends to render the circulation in a part equal, by preventing an increaſe or diminution of it.

As the blood is thoroughly mixed in the left ~~right~~ ventricle of the heart, and is diſtributed from thence to the different parts, no alteration in its attraction to the ſides of the veſſels can produce an increaſe or diminution of the circulation in a particular part.

It has been ſuppoſed, that a viſcidity in the fluids, or an increaſe of the ſize of their particles, often produced an obſtruction to the circulation; but this opinion has not been proved, or rendered probable, by any experiment hitherto made public: on the contrary, the red globules appear to be always nearly of the ſame ſize, except when they are broke down by putrefaction: the ſerum and coagulable lymph ſeldom or ever appear more viſcid than when in their common ſtate; and, if they were, their viſcidity would affect the ſyſtem equally.

The diſpoſition to contraction in the capillary veſſels, or the external preſſure, may be ſo much diminiſhed, as that the action of the heart continuing the ſame, the ſize of the veſſels of a part may be increaſed, ſo as actually to occaſion a greater circulation of blood in that part.

If the heart be the ſole cauſe of the circulation, the only material alteration that could take place in the proportion of the circulation in the different parts, muſt depend on an increaſe or diminution of the diſpoſition to contraction in the veſſels, or on an alteration in the external preſſure.

But the circulation may be increaſed in a particular part, the motion of the heart continuing the ſame, by cauſes which do not diminiſh the diſpoſition to contraction of the veſſels of that part, nor increaſe the diſpoſition to contraction in the veſſels in the other parts of the body, nor produce any effect on the external preſſure.

Therefore the heart is not the ſole power which propels the fluids through the part in which the circulation is thus increaſed.

The cauſes capable of increaſing the circulation in a part, are generally ſuch as tend to excite muſcular motion, and are called ſtimuli.

Some part of the body, brought into action by theſe ſtimuli, is capable of increaſing the circulation independent of the action of the heart.

The arteries are endowed with a muſcular motion, by which they may increaſe the circulation in a particular part, or aſſiſt the heart in the general circulation of the blood.

The arteries at each contraction of the heart are diſtended; at each relaxation they contract.

This alternate contraction and dilatation might depend on their elaſticity.

If their contractions and dilatations depended on their elaſticity, their ſize at their utmoſt contraction in the living body ſhould be equal to that produced by a fluid injected into them, with a force capable of overcoming the reſiſtance the blood meets with in the capillary veſſels, which, in the human body, is probably equal to eight feet perpendicular height of water.

But their ſize, even at their utmoſt ſtate of dilatation, is leſs than that produced by a fluid injected into them, with a force equal to one foot perpendicular height of water, when the animal is dead.

Therefore their contractions and dilatations do not depend on their elaſticity.

The additional force which occaſions an increaſe of the circulation, in a particular part, muſt depend on the action of the arteries or capillaries.

As the capillaries do not contract and dilate alternately, and as the direction of the blood in any one of them is quite undetermined, this additional force cannot depend on the action of the capillaries.

If the arteries contracted and dilated by their elaſticity, no additional force could be applied from their contraction and dilatation; ſince the heart would loſe more force, in diſtending the arteries, than they would re-apply to the blood in contracting.

If the arteries, upon being diſtended by the blood thrown into them by the heart, are excited to a muſcular contraction, and when they have performed this contraction relax, and like the ventricle of the heart, receive the blood eaſily into them, and when they are again diſtended, are excited to a ſecond contraction, they may apply an additional force to that of the heart, ſo as to promote the circulation through the whole body.

If ſuch contractions and dilatations be greater in any particular part, they will promote the circulation in that part; in as much as, when they are relaxed to a greater degree, they will ſuffer the blood to paſs through them more readily into the capillaries; and, when they contract, they will empty themſelves more thoroughly into the capillaries.

The arteries have a muſcular contraction and dilatation, ſimilar to that of the ventricles of the heart, by which they apply an additional power to that of the heart, ſo as to promote the general circulation through the whole body, and often to increaſe the proportional circulation in a particular part.

The motion of the blood is regulated by the action of the heart and arteries, and the contraction of the capillary veſſels; and theſe are meaſured by the pulſe.

The PULSE.

Indicates	by	It is called
1*ſt*, THE ſtrength of the contraction of the heart,	Strength,	Strong.
	Weakneſs,	Weak.
2*dly*, The quantity of blood thrown out at each contraction,	Fulneſs,	Full.
	Smallneſs,	Small.
3*dly*, The number of contractions,	Frequency,	Frequent.
	Slowneſs,	Slow.
4*thly*, The regularity of its action, as to ſtrength, quantity or frequency,	Regularity,	Regular.
	Irregularity,	Irregular.
	Intermiſſion,	Intermittent.
5*thly*, The ſtrength of the action of the arteries,	Hardneſs,	Hard.
	Softneſs,	Soft.
	Redoubling,	Redoubling.
	Trembling,	Trembling.
6*thly*, The irrtiability of the veſſels,	Quickneſs,	Quick.
	Regularity,	Regular.
	Slowneſs,	Slow.
7*thly*, The medium diameter of the arteries,	Dilatation,	Great.
	Contraction,	Small.
8*thly*, The quantity of blood in the veſſels,	Oppreſſion,	Oppreſſed.
	Smallneſs,	Empty.
9*thly*, The contraction of the capillaries,	Obſtruction,	Obſtructed.
	Freedom,	Free.

The STRUCTURE of the LUNGS.

THERE is a ſet of veſſels in the lungs which contain air, and another which contain blood.

The AIR VESSELS.

The air veſſels conſiſt of a pipe, called the trachea; one end of which opens into the throat, and communicates with the amtoſphere by the noſtrils and mouth; the other divides into branches which go to every part of the lungs, and whoſe ends open into ſmall cavities, or cells.

The air in the lungs is generally in motion; for either that which is at preſent contained in the cells, is paſſing through the trachea into the atmoſphere, or a freſh parcel is paſſing from the external atmoſphere through the trachea into the cells.

The whole of this motion is called reſpiration: when the air is paſſing in, it is called inſpiration; when it is thrown out, expiration.

When the thorax is enlarged by the action of one ſet of its muſcles, the preſſure of the external atmoſphere forces the air into the lungs; the other ſet of muſcles which contract the thorax when put in action, force the air out of the lungs into the atmoſphere. But the preſſure of the atmoſphere on the ſurface of the body counterbalancing its preſſure on the ſurface of the lungs, neither the muſcles of inſpiration nor thoſe of expiration are aſſiſted or counteracted by it.

If the air continues at reſt in the lungs for many minutes, or if a man continues to reſpire the ſame air, or if he breathes air that hath ſerved for the inflammation of fuel or pure fixable air, he dies.

It is not determined whether pure inflammable air will ſerve for reſpiration.

Some vapours kill immediately if taken into the lungs, independent of their being unfit for reſpiration.

The BLOOD-VESSELS.

The ~~air~~ blood veſſels of the lungs conſiſt of two ſets, viz.

1ſt, The Pulmonary.

2dly, The Bronchial.

The PULMONARY VESSELS.

The right ſide of the heart is ſimilar to the left, excepting that both the auricle and ventricle have fewer muſcular fibres, and that the auricle receives blood from the venæ cavæ, and the ventricle throws it into the pulmonary artery.

The pulmonary artery begins at the right ventricle of the heart, and goes from thence to every part of the lungs in the ſame manner that the aorta goes to every part of the body.

When the pulmonary artery hath divided into very ſmall branches, theſe do not open into one another and form anaſtomoſing veſſels like the ſmall branches of the aorta; but they join again, and form veins, which uniting together, go to the left auricle of the heart commonly in five trunks.

The

The CIRCULATION of the BLOOD through the PULMONARY VESSELS.

The blood paſſes from the right auricle into the right ventricle, from the right ventricle into the pulmonary artery, from the pulmonary artery into the pulmonary veins, and from the pulmonary veins into the left auricle,

The POWERS propelling the BLOOD through the LUNGS.

The muſcular fibres of the right auricle contracting, propel part of the blood contained in it into the right ventricle, and they are aſſiſted by the force with which the blood moves in the veins.

The muſcular fibres of the right ventricle being ſtimulated to contract when it is full, propel part or the whole of the blood contained in it into the pulmonary artery, the blood being prevented from returning into the auricle by the valve placed at the opening of the auricle into the ventricle.

After the ventricle has contracted, it relaxes and receives the blood from the auricle, it being prevented from returning from the pulmonary artery by the valves placed at the opening of the pulmonary artery into the ventricle.

The blood is thrown by the right ventricle through the pulmonary artery and veins into the left auricle.

Perhaps the pulmonary artery hath a muſcular power, ſimilar to the muſcular power of the other arteries, by which it promotes the circulation of the blood through the lungs.

The blood meets with the ſame obſtructions in its paſſage through the lungs that it does in its paſſage through the other parts of the body, excepting that there being no anaſtomoſing veſſels, there is no obſtruction from the ſtreams of the blood meeting in them, and oppoſing each others motion.

The blood meets with ſome additional obſtructions in its paſſage through the pulmonary veſſels, beſides thoſe it meets with in the other parts of the body, viz.

1ſt, The motion of the lungs in reſpiration, as there are no valves in the veſſels, tends to retard the circulation, although the reverſe hath been aſſerted.

2dly, If a ſufficient quantity of reſpirable air be not received into, and thrown out of the lungs, the motion of the blood in the pulmonary veſſels is conſiderably retarded.

The BRONCHIAL VESSELS.

An artery ariſes from the aorta, and ſpreads itſelf through the lungs, terminating in anaſtomoſing capillary veſſels, which open into veins in the ſame manner as the other branches of the aorta in other parts of the body.

The blood circulates in theſe veſſels in the ſame manner as in the other veſſels, ariſing from the aorta in other parts of the body.

The

The EXTRAVASATION and ABSORPTION of the LYMPH.

PART of the ſuperfluous water and ſerum is continually paſſing through the ſides of the veſſels, particularly the capillaries, into the cellular membrane, and all the cavities of the body, ſo as to keep their ſurfaces moiſt.

It has been ſuppoſed that they paſſed through tubes appended to the ſides of the blood-veſſels; but ſuch veſſels have never been demonſtrated, nor is there any reaſon for ſuppoſing that they exiſt, excepting in the glands.

The fluids, commonly extravaſated, have been called the lymph.

It is uncertain whether it paſſes through the accidental pores in the ſides of the veſſels, or by cylindrical organiſed holes; but it is moſt probable that it paſſes through organiſed holes, as the ſecretion is regular and conſtant.

The pores or veſſels it paſſes through, are called exhalants.

It is abſorbed by the lymphatics.

A lymphatic is a tube nearly cylindrical, divided by valves, ſo as to have the reſemblance of joints.

They ariſe from the cellular membrane, and cavities, and the greateſt part of them go to the thoracic duct.

The valves allow the lymph to paſs from the cavities to the thoracic duct, but prevent its paſſing from the thoracic duct to the cavities.

The lymphatics in paſſing from the cavities to the thoracic duct, go through the lymphatic glands.

The ſtructure and uſe of theſe glands are not as yet aſcertained.

The thoracic duct is a tube which begins near the diaphragm, and commonly terminates in the left ſubclavian vein.

At its opening into the left ſubclavian vein, there is a valve which allows the lymph to paſs from it into the vein, but prevents the running of the blood from the vein into the thoracic duct.

Some of the lymphatics terminate in veins. Theſe are ſimilar in ſtructure to thoſe which terminate in the thoracic duct.

The POWERS *producing the* EXTRAVASATION *and* ABSORPTION *of the* LYMPH.

The contractile power of the blood-veſſels ſqueezes the lymph into the cellular membrane and cavities.

The quantity thrown out is in proportion to the force of the circulation, the fluidity of the ſubſtances contained in the blood-veſſels, or the quantity of the more fluid ſubſtances, and the degree of contraction of the capillaries and exhalants.

The joint of a lymphatic opening into a cavity, endeavours to fill itſelf from that cavity by its action as a capillary tube, the valves preventing the return of the lymph from the other part of the lymphatic. In like manner a lymphatic may fill itſelf entirely from the cavity in which it terminates, but its action as a capillary tube will not tend in the ſmalleſt degree to propel the lymph into the veins.

It is moſt probable that the joint of the lymphatic, next to the cavity, having abſorbed a ſufficient quantity of lymph to fill it, is ſtimulated to contract and propel the fluid into the next joint, and ſo on to the thoracic duct, or vein, in which it terminates; and having emptied itſelf, and being relaxed, it fills itſelf again from the cavity, and ſo continues to act: for there is apparently no other power in the body capable of producing a regular flow of the lymph through the lymphatics into the blood-veſſels.

For in a living animal where the veins are contracting, and preſſing the blood, if one end of a capillary tube terminate in a vein, and the other in a cavity; and if there be no action in that tube, excepting that which ariſes from its being a capillary one, or from the motion of the blood in the vein; if there be any motion in that tube after it is full, it will always be from the vein into the cavity, and never from the cavity into the vein, let the tube be of any ſize or ſhape whatever.

Further; the alternate preſſure of the lymphatics ariſing from the alternate contractions and relaxations of the blood-veſſels, or muſcles, is not ſufficiently powerful, univerſal, or equal, to produce a regular flow of the lymph through the lymphatics into the blood-veſſels.

Neither does the cellular membrane and cavities force the lymph into the lymphatics, and through them into the veins.

The extravaſation of fluids from the blood-veſſels into the cellular membrane and cavities, and their reabſorption, generally take place in the above manner.

Sometimes the coagulable lymph is thrown out by the exhalants.

When the coagulable lymph is thrown out, it moſt commonly coagulates.

If it coagulate, it cannot be taken up by the lymphatics, till it be rediſſolved.

In many caſes it rediſſolves, and is abſorbed much ſooner than it can be rendered ſoluble in water, by putrefaction when out of the body. At other times it continues in the cavity for many years.

The red part of the blood is alſo ſometimes thrown out by the exhalants. In this caſe, its particles are broke down probably by the firſt ſtage of putrefaction, and it is afterwards reabſorbed.

The ſame things may happen, if the red particles and coagulable lymph are extravaſated in conſequence of the rupture of a blood-veſſel.

In particular parts, as in the corpora cavernoſa penis, the extravaſation and abſorption is probably performed in a different manner, and by different veſſels.

All abſorbent veſſels muſt have a power of propelling the fluids into the blood-veſſels, ſufficient to overcome the force of their contraction, by which they endeavour to propel the blood out of any opening.

The HEAT of the HUMAN BODY.

THE bodies of quadrupeds have a diſpoſition to maintain the ſame degree of heat nearly.

The heat of quadrupeds of the ſame ſpecies is generally the ſame, eſpecially in mankind.

The common heat of the human body in health, is ninety-eight degrees of Fahrenheit's thermometer.

The heat is the ſame throughout the whole body, excepting that a cold ſubſtance applied to the ſkin diminiſhes its heat; and the heat of the blood, flowing from a vein in an extremity that is expoſed to a cold atmoſphere, is reduced two or three degrees.

Otherwiſe the heat continues the ſame, whether that of the atmoſphere, or other ſurrounding bodies, be greater or leſs than ninety-eight degrees, unleſs when it produces a diſeaſe; the conſequence of which is an increaſe or diminution of the heat of the body.

The body is capable of reſiſting different degrees of external heat or cold, according to the habit it has acquired. There are inſtances of its bearing 20 degrees below 0 of Fahrenheit's thermometer, with very moderate cloathing, and 115° above, without alteration.

The heat may be increaſed or diminiſhed by alterations in the body itſelf, eſpecially in diſeaſes.

The heat has ſeldom been obſerved to be leſs than ninety-four, or more than a hundred and ten degrees of Fahrenheit's thermometer.

An increaſed action of the living power in any part, or in the whole body, increaſes the heat; and *e contra*, a diminution of the action of the living power, diminiſhes the heat either in quantity or degree.

Fluids rubbing againſt ſolids, or very ſmall particles of a ſolid immerſed in a fluid rubbing againſt one another, or againſt a ſolid, produce no ſenſible heat; therefore neither the friction of the blood againſt the veſſels, nor the friction of the red particles againſt one another, or againſt the veſſels, produces, maintains, or regulates the heat of the body.

It has not been proved, by any experiment hitherto made public, that the fermentations producing, or deſtroying the fluids, generate heat; and if it were, theſe fermentations do not go on ſo regularly, univerſally, or conſtantly, as to produce, maintain, or regulate the heat of the body.

The heat is not at all in proportion to the evaporation, as a double quantity evaporated by the inſenſible perſpiration, makes no alteration in the heat.

The power which produces, maintains, and regulates the heat of the human body in health, produces heat when the ſurrounding ſubſtances are heated to a leſs degree than 98 of Fahrenheit's thermometer, and cold, when they are heated to a greater degree.

The Nervous System.

THE brain is a ſoft maſs, internally of a white colour, externally of a greyiſh or aſh colour.

It is furniſhed with blood-veſſels in the ſame manner as the other parts, excepting that larger arteries anaſtomoſe, and the ſmaller veins enter more ſuddenly into a large trunk, whoſe ſides are of a firmer texture.

In quadrupeds it is contained in the cavity of the head.

In man it is in a larger proportion to the whole body, than in any other quadruped, or any bird or fiſh hitherto known.

From the white part maſſes of fibres ariſe, which go to every part of the body. Theſe are called nerves.

One large maſs paſſes down through the cavity of the ſpine, and is called the ſpinal marrow.

A little of the cineritious part, is contained in the middle of this, and alſo in the optic nerves.

The brain, ſpinal marrow, and nerves, are covered with membranes of a much firmer texture.

The nerves proceed from the brain in trunks, which branch out as they paſs to the different parts, of the body.

Upon examining the trunks with a microſcope, they appear to conſiſt of very ſmall fibres, which are only ſeparated from one another in the branching.

In their paſſage they ſometimes join again, forming roundiſh maſſes called ganglions, from whence they proceed to the different parts.

When they divide into very ſmall branches, they have been ſuppoſed to become ſofter, and ſeem to go to every the ſmalleſt part.

The

The SENSIBILITY, MOBILITY, and IRRITABILITY of the BODY.

THE ſenſibility is a property of the body, by which external ſubſtances applied to it, excite ſenſations in the mind.

The mobility is an original power of motion, by which certain parts of the body are capable of moving themſelves without any external motion impreſt.

The Irritability is a property of the body, by which external applications to particular parts excite a motion in the moveable parts, independent of the motion impreſt.

Theſe properties depend on the brain and nerves.

The SENSIBILITY.

The ſenſibility depends entirely on a part's being connected with the brain by the nerves; for,

If the nerves going to any part be cut through, the ſenſibility is loſt.

If the nerves going to any part be moderately compreſt, the ſenſibility is diminiſhed.

If the nerves be compreſt ſtrongly, the ſenſibility is loſt.

If the preſſure be ſoon removed, the ſenſibility recurs.

If the preſſure be continued for a long time before it is removed, the ſenſibility returns more ſlowly, or not at all.

Preſſure on the brain, diminiſhes the ſenſibility of the whole body.

If a ſmall branch of a nerve be cut through, ſo as to take off the ſenſibility of a part of the ſkin, it may be reſtored in time.

The ſenſibility may be impaired, or loſt, without any ſenſible preſſure on the nerve, or alteration of its ſtructure.

When there is no wound in the body, the ſenſations appear to be in the place where the application exciting them is made.

If an extremity be cut off, an application made to the ſtump, may produce ſenſations which appear to be in the part amputated.

Query. Can a ſenſation be excited apparently in a part by an affection of the nerve going to it, the body being whole?

Every part of the body is capable of ſenſation in a ſound or morbid ſtate.

The bones and cartilages do not appear to be ſenſible in a ſound ſtate, whatever application be made to them; but in a morbid one they may become ſenſible.

All the other parts of the body appear to be ſenſible in a ſound ſtate; for the diſtention of a part conſiderably beyond its preſent diſpoſition to contract, either by its muſcular power or elaſticity, is capable of exciting ſenſations in every other part of the body.

There are applications, which are capable of exciting ſenſations in one part, that produce no ſuch effect in another.

Some of the ſenſible parts are only capable of ſenſation from diſtention in a ſound ſtate, ſuch as the membranes.

One part may be ſenſible to an application which another is not, and the ſecond part may be ſenſible to another application, which the firſt is not; as the effluvia of muſk do not affect the eyes, although they affect the noſtrils, and the rays of light affect the eyes, but not the noſtrils.

Some parts of the body are only capable of the ſenſation of pain; others are capable of various ſenſations, of which pain is always one.

Some applications are capable of exciting pain only; others may excite various ſenſations.

Every ſenſation excited in a very great degree, is painful, and ſeveral are alſo painful from being very weak.

Thoſe parts of the body, which are capable of a variety of ſenſations, are generally called the organs of the ſenſes. Theſe are,

The ſkin, the mouth, the noſtrils, the eyes, the ears; the ſtomach is capable of ſeveral ſenſations beſides pain, but not of ſo great a variety as the organs of the ſenſes.

Some other parts of the body are alſo capable of ſome ſenſations not painful.

All the ſenſible parts may have their ſenſibility increaſed or diminiſhed.

The MOBILITY *and* IRRITABILITY.

Parts capable of original motion, are called the moving parts.

In many of the parts capable of original motion, there are red fibres called muſcular fibres.

In ſome of the parts capable of original motion, no ſuch fibres have hitherto been demonſtrated.

All the parts of the body are not capable of original motion.

The muſcles, blood-veſſels, lymphatics, ſecretories of the glands, and ſkin, are capable of original motion.

The moving parts are capable of contracting beyond that degree of contraction which would ariſe from their elaſticity.

All the actions of the body, and all the power which it exerts, depend upon the contraction of the moving parts.

When a muſcular fibre, or any other moving part, continues in action for a conſiderable time, it does not, in general, exert one continued contraction, but a number of alternate contractions and relaxations. The relaxations, when the body is ſtrong, or the whole ſtrength is not exerted, are often hardly diſtinguiſhable; but when the habit is weak, or the whole force exerted, they become very apparent.

A contraction may however probably continue for a very long time, without any intermediate relaxation, as in a ſpaſm.

When any motion takes place in conſequence of a relaxation, it is from the elaſticity or weight of the part, or from ſome external power.

The original motions are produced by volition ideas of the mind, or certain external applications, called ſtimuli.

There muſt be the ſame intercourſe, which is neceſſary for ſenſation, between the moving part, and the brain, by means of the nerves, to render volition capable of exciting a motion in it.

Many of the moveable parts are incapable of being put in motion by the will.

An idea of the mind may excite a motion independent of, and contrary to the will, provided the part be connected with the brain by the nerves, as for ſenſation.

The will may acquire a power over a moving part, which it could not affect originally.

The motions excited by the will are called voluntary motions; thoſe excited by ideas, or ſtimuli, independent of, or contrary to the will, are called involuntary.

All the parts of the human body, capable of voluntary motions, have red muſcular fibres.

The will and ideas are both capable of producing contractions and relaxations in the moving parts.

If the communication between the brain and a moving and irritable part, be cut off by cutting thro' the nerve, a motion may be ſtill excited in it by a ſtimulus; hence ſtimuli may excite motion without affecting the brain, and therefore all the motions excited by them, are not begun in the brain, and carried along the nerves to the moving part.

If a nerve be cut through, ſo as to leave a portion of it adhering to a moving part, a ſtimulus applied to the nerve, may excite a motion in the moving part. Hence, the action of a nerve upon a part, may excite a motion in it; and the motions excited by the nerves, do not all ariſe in the brain.

If the communication between the brain and a moving part by the nerves continues, a ſtimulus applied to the brain may excite a contraction of the moving part.

The motions produced by the application of ſtimuli to moving and irritable parts are apparently the ſame, whether the part be connected with the brain by the nerves, or not; excepting that the motions excited, become more languid after the moving part has been ſeparated ſome time from the brain, and at laſt the power of motion in it is entirely loſt.

The ſame things are true of the motions excited by the application of ſtimuli to the nerves going to a moving part.

Hence, it is probable, that the motions excited by the application of ſtimuli to a moving and irritable part, or to the nerve going to a moving part, do not ariſe in the brain, but immediately in the nerves, or in the part; the brain in this caſe only keeping up the life of the part, and rendering it capable of motion.

When a ſtimulus produces a contraction in a moving fibre, the force of that contraction is often far greater than the force with which the ſtimulus was applied. Therefore, when a ſtimulus excites a motion, it is not in conſequence of a communication of the power employed in applying that ſtimulus: nay, the motion may be the very reverſe of that which would have been produced by the exertion of that power.

When a ſtimulus applied to a nerve produces a contraction in a moving fibre, it is a queſtion whether the motion is excited in the nerve, and communicated to the fibre, or produced immediately in the fibre, without any motions being excited in the nerve; for in this laſt there is often no apparent motion excited.

It has been conjectured by ſome, that the motion was communicated by a fluid flowing through the nerves as tubes; by others, that it was communicated by vibrations; and by others, that it ariſes from an elaſtic vapour ſurrounding the nerves: but none of theſe conjectures are founded on experiment, neither are any of them any ways capable of accounting for the appearances.

As the influence of a ſtimulus on a moving fibre is not occaſioned by any mechanical communication of motion, may not a ſtimulus applied to a nerve, exert its influence on a contractile fibre, without any mechanical communication by any motion running along the nerve.

If the brain is not diſeaſed, and two parts of the body communicate with it by the nerves, as for ſenſation, an application made to one of theſe parts may excite a contraction or relaxation in the other, although none of the ſubſtance applied, be carried from the one to the other, and although no ſenſation be excited by the ſtimulus. Hence a medicine applied to one part of the body, may produce an effect upon another, although none of that medicine be carried to the part on which that effect is produced.

The effect of an application upon a part at a diſtance from that where it is made, may be the ſame which it would have produced if applied to that part; or it may be the reverſe, or totally unconnected with it.

Quer. May not the application in this caſe influence the diſtant part, without any communication from a mechanical motion running along the nerves of the one part to the brain, and from the brain by the nerves to the other part?

An application to one part, may produce a motion in another, although it would have had no effect, if it had been made to the part itſelf

A ſtimulus applied to a part incapable of original motion, may excite a motion in a moving part at a diſtance.

If the communication between the brain and any part of the body, by means of the nerves, be cut off, applications made to that part, will not affect the other parts, nor will applications to the other parts, produce motions in that; unleſs the nerves be cut off from a muſcle, whoſe fibres have been accuſtomed to contract at one and the ſame time, ſuch as the heart.

In

In that caſe, if you ſtimulate one of theſe fibres, the whole are brought into immediate contraction; thoſe not ſtimulated, contract, to all appearance, as ſoon as the one to which the ſtimulus is applied.

As in this caſe the communication between the fibres by the nerves is cut off, and as after cutting thro' the nerves of a ſmall part of the body, the ſenſation may in time be reſtored, is there not a communication of nervous influence, between the parts that are in contact, independent of the nerves?

The parts on which ſtimuli are capable of acting ſo as to produce motion, are called the irritable parts.

All the parts of the body are irritable in a ſound ſtate, excepting the bones, cartilages, and tendons.

All the parts of the body may become irritable in a morbid ſtate.

Stimuli may produce motion in a diſtant part, when applied to a part incapable of original motion; or, in other words, all the irritable parts are not moving parts.

An application that produces relaxation, or diminiſhes contraction, is called a ſedative.

A ſubſtance may act on one part as a ſtimulant, on another as a ſedative.

A ſubſtance may act on one part as a ſtimulant or ſedative, and have a leſs effect, or none at all, when applied to another, although otherwiſe equally irritable. Such ſtimuli are called ſpecific.

There are ſome parts upon which ſtimuli in general produce greater effects than they do upon others.

A greater number of ſubſtances act alſo upon theſe parts.

The membranes, ligaments, and blood-veſſels, excepting the heart, are incapable of being affected by any other ſtimulus but diſtention.

Some of the applications capable of affecting the moving parts, tend to deſtroy the fibres by mechanical or chemical effects; ſome of them have no mechanical or chemical power of action.

The irritability and mobility of a part may be increaſed, diminiſhed, or entirely loſt.

CUSTOM and HABIT.

CUSTOM is the frequent repetition of any application to the body, capable of affecting the ſenſible or irritable parts, or it is the repetition of any action or motion of the body.

Habit is the effect of ſuch repetition.

An application, producing a ſenſation, may have its power increaſed or diminiſhed by cuſtom.

If the mind pays particular attention to any impreſſion, its force and diſtinctneſs is increaſed. Hence ariſes the improvement of the eye, ear, &c. in diſtinguiſhing objects in painting, tones in muſic, &c.

If the impreſſions are very ſtrong, ſo as to excite great attention, their force is increaſed.

If the impreſſions are not attended to, their force is diminiſhed. Hence after living for ſome time near any thing producing a great noiſe, the noiſe is hardly heard.

The power of the will, in producing motion, may be increaſed by cuſtom, and diminiſhed by diſuſe.

The will, in frequently producing a motion, may not only have its power increaſed, but it is alſo capable of producing that motion with greater accuracy, and by frequent attempts may acquire a power over a moving part, upon which it has naturally little or no influence.

A motion may ariſe from a volition in conſequence of cuſtom, which was not naturally connected with it; as a man in turning in a loom does not will the motion of his hand, but of the end of the chizel.

Quer. Can a man produce two diſtinct motions by his will at once; or, when two diſtinct motions are produced, does the will produce them ſucceſſively? The impreſſion ariſing from one volition remaining till the mind renews it, after having produced the other, in the ſame manner as the impreſſion of a flame making a circular motion, remains on the eye, ſo as to give an idea of a compleat circle.

The power of producing two diſtinct motions, apparently at the ſame time, is greatly increaſed by cuſtom.

From the above circumſtances the facility of execution acquired by cuſtom ariſes.

The power of an idea in exciting motion, may be increaſed or diminiſhed by cuſtom.

An idea ſtrongly impreſt on the mind, is for the moſt part more powerful in exciting a motion, than one weakly impreſt.

The power of an application in impreſſing an idea, may be increaſed or diminiſhed by cuſtom, as is above deſcribed, and of conſequence the power of an idea in exciting motion.

Suppoſing the impreſſion on the mind the ſame, if an idea has frequently produced a motion, its power is increaſed. On the contrary, if an idea has been often excited, and if the motion depending upon it has by any means been prevented, its power is diminiſhed, or loſt.

The action of an application producing, diminiſhing, or altering the mode of, contraction of a moving part, and which at the ſame time has no effect on the mind, may be increaſed or diminiſhed by cuſtom.

If it be often applied, ſo as always to produce its effect, its power, or the certainty of its action, is for the moſt part increaſed.

An application of an equal apparent force does not always produce the ſame effect. If the ſame quantity of ipecacuhan be twice exhibited at the interval of ſeveral days, it may vomit at the firſt exhibition, and not at the ſecond; or it may produce vomiting at the ſecond exhibition, and not at the firſt.

In applying medicines, which do not act as ſimple ſtimuli, their particular effect cannot be increaſed by increaſing the doſe, they being converted into ſimple ſtimuli. Thus ſmall doſes of ſaccharum ſaturni produce coſtiveneſs, but a very large doſe frequently purges.

An application frequently repeated, ſo as to produce its proper effect, often becomes more conſtant and uniform in its action, although it may become neceſſary that it ſhould be applied in a greater degree.

If an evacuating medicine be repeatedly exhibited, it generally requires a larger doſe at the ſecond, and ſome of the ſubſequent exhibitions, to produce the ſame effect as the firſt; but if theſe produce the effect, the power of the medicine is afterwards increaſed.

The more violent the effect of any application, the more is its power increaſed by repetition.

If an application be made in ſo ſmall a degree, as not to produce any effect, or if its effects are by any means counteracted, its power is diminiſhed or loſt.

The repeated application of ſome medicines in any circumſtance diminiſhes their powers.

All the natural powers of action in the body are increaſed by frequent exertion.

If two or more fibres have been accuſtomed to contract together, either by the action of the will, by an idea, or by ſtimuli; or if the contraction in one of them be produced by the will, while the other is brought into action at the ſame time by a ſtimulus, the producing of a contraction in the one by an application to it alone, will produce a contraction in the other. If they be fibres of the ſame muſcle, and acted upon by a ſtimulus, this will happen after the communication with the brain by the nerves is cut off, but not otherwiſe.

If, after this habit is acquired, one of theſe fibres is made to contract frequently, while the other is prevented from contracting, the habit is loſt or deſtroyed.

If any motion, or ſtate of the body, be repeated at a particular period of time, it will often return at that period, although no other cauſe be applied but the habit acquired.

A habit may be deſtroyed by counteracting and preventing its effects.

Two habits may be ſo connected, that preventing the one from taking place, may prevent the effects of the other.

Cuſtom has alſo a powerful influence on the mind.

EXERCISE, REST, SLEEP.

WHEN a moving part is brought into action by the will, an idea, or ſtimulus, that action ſometimes ceaſes upon removing the cauſe, ſometimes it continues after the cauſe is removed. This laſt frequently happens in the production of diſeaſes.

When it is neceſſary for the continuation of an action, that its cauſe ſhould be continually or repeatedly applied, the original power ſeems gradually to be exhauſted, ſo that the motions for the moſt part become gradually weaker, and at laſt are not to be produced, as in the caſe of exerciſe.

There are ſome actions which are neceſſary for life, that are continued by the application of ſtimuli, and nevertheleſs do not exhauſt the original power; ſuch as the action of the heart, the periſtaltic motion of the inteſtines, &c.

If theſe actions are increaſed beyond their common pitch, or beyond what can be allowed by the preſent ſtrength of the ſyſtem, they alſo exhauſt the original power.

A great exertion of the faculties of the mind alſo, exhauſts its powers.

Reſt reſtores both to the body and mind their powers of action

In perfect ſleep, both the body and mind are at reſt, excepting in thoſe particulars where an exertion is neceſſary to life. Theſe exertions are in the alternate contractions of the heart and arteries, the motion of the muſcles in reſpiration, the tone of the muſcular fibres, blood-veſſels, and other moving parts, the action of the lymphatics and excretory ducts, the periſtaltic motion of the inteſtines, &c.

The common exertions of the body and mind, when a man is awake, exhauſt to ſuch a degree, as to require that reſt which is found in ſleep to allow the original power to recruit itſelf.

In ſleep the mind is often brought into action, ſometimes from affections of its own, ſometimes from affections of the body. The body alſo exerts other powers beſides thoſe neceſſary for life. In theſe caſes the original power is leſs recruited, and that in proportion to the exertion.

Although the original power may be ſo far exhauſted as to require to be recruited by ſleep, that ſtate may neverthleſs be prevented by any thing exciting great attention of the mind, by applications to the body producing uneaſineſs or pain, or by an increaſed action of any of its parts, or by any action or contraction which continues after its cauſe is removed.

The ſame cauſes may render ſleep leſs perfect, although not ſufficient to prevent it altogether.

Although reſt is not compleat at the beginning of ſleep, it has a tendency to become ſo during this ſtate of the body. In particular, all actions and contractions remaining after their cauſe has been removed, are apt to go off.

During ſleep the original power appears to be ſo much accumulated, as to give a diſpoſition to action, both to the mind and body, from the ſlighteſt cauſe, and this ſtate of the body goes off of courſe.

At the beginning of ſleep, the reſt is generally leſs perfect; it becomes gradually more ſo for a certain time afterwards. When the original power is recruited, the mind begins to be put in action, and at laſt the whole ſyſtem, at which time ſleep goes off.

A continued or ſtrong action of one part of the body, may not only exhauſt the original power in that part, but alſo in all the others.

A great exertion of the powers of the body, may exhauſt the powers of the mind, and *é contra*, a great exertion of the powers of the mind, may exhauſt thoſe of the body.

A frequent exertion of the original power in one part of the body, tends to ſtrengthen that part, but to weaken the other.

An exertion of the original power, increaſes the loſs of fluids, and renders a greater quantity of food neceſſary. Hence animals that require a conſiderable quantity of nouriſhment when awake, may ſleep for ſeveral months without any being taken in.

A loſs of fluids generally increaſes the powers of digeſtion, excepting when they are diſordered by diſeaſe.

A moderate exertion of the powers of the body, in proportion to the preſent ſtrength, powers of digeſtion, food, and ſleep, tends to ſtrengthen the whole body.

A violent or continued exertion of the original power, if it be not recruited by food and ſleep, may weaken to that degree as to kill.

A repeated exertion of the powers of the mind, tends to ſtrengthen its faculties; but at the ſame time to weaken the original power in the body.

Unleſs the body be endowed with a certain degree of ſtrength, the mind cannot exert itſelf powerfully.

Exerciſe of the powers of the body, tends to weaken the mind, except ſo far as is neceſſary to give the body the proper ſtrength.

But a moderate exerciſe of the body and mind together, tends to ſtrengthen the whole ſyſtem, ſo that by cuſtom the original power in the whole may be increaſed.

FINIS.